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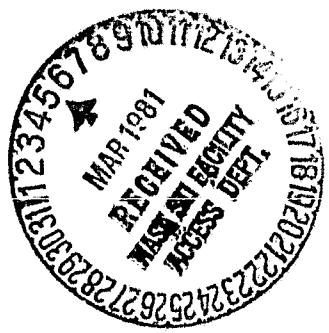

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ADVANCED PLANNING AND TECHNOLOGY OFFICE
KENNEDY SPACE CENTER

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I. EARTH RESOURCES

1. Transfer of Three-Dimensional Thermal Plume Mathematical Model to EPA

A two-year project has been completed with EPA in Research Triangle Park, North Carolina, to demonstrate and transfer a three-dimensional thermal plume mathematical model. This model, developed by KSC and the University of Miami over a four-year period, is generally considered to be state-of-the-art and is universally applicable to any power plant whether it discharges into lakes, rivers, estuaries, or the open sea. This model has been verified to have an accuracy of $1^{o}C$ on the surface or any subsurface point in a thermal plume. Verification was established during the development phase by conducting aerial infrared thermal scanner runs coupled with in situ data at various power plant sites in Florida and the Carolinas.

During the two-year demonstration and transfer project to EPA, the model prediction capability was demonstrated in an open sea discharge and in a lake discharge. The open sea discharge demonstrated the free surface version of the model and was conducted at the Anclote Power Station which discharges into the Gulf of Mexico near Tarpon Springs, Florida. The lake discharge demonstrated the rigid lid version of the model and was conducted at Lake Keowee, South Carolina, which receives the thermal discharges from the Oconee Nuclear Power Station located near Clemson, South Carolina. An EPA team worked closely with a KSC team during two model verification demonstrations performed at each of the two sites.

During the second year the rather large and complicated model was transferred from the University of Miami computer facility in June 1980 to the EPA National Computer Center in Research Triangle Park, North Carolina. This operational capability includes the automatic drawing of isotherm contours by an ancillary plotter. EPA can now utilize this model as an important decision tool for optimum siting resulting in minimum thermal pollution of future power plants.

2. Transfer of Landsat Analysis to EPA for Parameter Assignments in a Watershed Water Quality Model

For the past several years KSC has been cooperating with EPA Athens, Georgia, Research Laboratory in evaluating the applicability of remote sensing to develop input parameters for a watershed water quality model called Hydrologic Simulation Program FORTRAN (HSPF). This activity has recently culminated in a test which compared model

results obtained by remote sensing derived input data with conventionally assigned input data. This test was conducted using the Occoquan Basin in northeastern Virginia as a test site. Ground truth and ancillary data of the 1975-1976 time period was provided by the Northern Virginia Planning District Commission (NVPDC). Landsat classifications in this time period were made by KSC and the ancillary data was associated with the Landsat analysis by JPL's Image Based Information System (IBIS).

Overall accuracy results were considered to be virtually equal for the two data bases. However, the remotely sensed data base has significant cost savings over a conventional one in both set up and operations. Also Landsat land cover classifications coupled with IBIS can give rapid and complete results over a very large watershed, eliminating much drudgery in the manual effort. There is therefore greater objectivity, reliability, and repeatability in the remotely sensed data collection process.

This project has been completed and a report issued documenting the comparison of the two data bases. Efforts are now underway to transfer Landsat analysis capabilities to EPA.

3. Aerial Color Infrared Photography: Applications to Citriculture

KSC, in cooperation with the Extension and Research Branches of the University of Florida's Institute of Food and Agricultural Sciences (IFAS), has developed techniques for the improved management of citrus groves using aerial color infrared photography. The developed techniques include (a) a grove mapping system to facilitate information presentation and analysis, (b) photointerpretation process of the extraction of information of a wide variety of grove management problems, and (c) a computerized system of storage and retrieval of management information. The information gained has been summarized and is being published in a NASA Reference Publication 1067, titled, "Aerial Color Infrared Photography: Applications in Citriculture," due to be released in December 1980.

These techniques are currently under consideration for a number of other applications in this country and abroad. The United States-Israel Binational Agricultural Research and Development (BARD) fund has approved and funded a three-year project to study the application of these techniques to the entire citrus industry in Israel. This project is now underway. Additionally Mexico has demonstrated an interest in adopting the techniques to their citrus industry. Discussions are still in process toward developing that application.

In this country, other potential applications which have been identified and are currently being explored include peach orchards in South Carolina, pecan groves in Florida and Georgia, and other agricultural crops such as peppers, potatoes, and cereals.

II. ADVANCED DEVELOPMENT

1. Fiber Optics Research

On-site testing is continuing on the two kilometer fiber optics cable. Meaningful environmental data has been gathered to allow a high grade system to be established for KSC use and to identify operating parameters for baseline design information. Pulse dispersion measurements were investigated to determine the operational limits of fiber optics transmission systems. KSC anticipates the need for high digital data rates, voice and television transmissions, and other multiplexed signals, in support of extended launch operations requirements.

2. Operational Intercommunications System (OIS) Improvement

Due to the increasingly complex Shuttle requirements on the originally installed OIS at KSC, it became necessary to consider either replacing the old system or improving it to reduce downtime. An improved end instrument was developed and is currently in limited use. However, in view of recent advancements in digital communication systems, a research effort is underway to compare the reliability and O&M costs of the modified versus the new technology to determine the final configuration.

3. Multimission Repair for Thermal Protection System (TPS)

Shuttle Orbiter multimission TPS repair is continuing in this applied research effort. The repair technique being developed will allow repaired tiles to be flown for more than single mission as is now the baseline. The Flexible Reusable Surface Insulation (FRSI) which resulted from this research is also easier to install. In the course of this research activity, test procedures were also developed to detect water, hydraulic fluid, and other contaminants.

4. Lightning Research

Lightning research studies are continuing in support of prelaunch, launch, and recovery operations for both KSC and the Air Force. The use of the expanded KSC/AF lightning instrumentation system together with previously developed technology at KSC is expected to improve the safety of operations to personnel and equipment, minimize costs of launch operations due to delays caused by weather conditions. KSC personnel are training Air Force personnel in the use of this system which displays the potential lightning charge and predicts

the discharge location. A commercial lightning strike location system was also demonstrated in actual strike conditions.

III. TECHNOLOGY TRANSFER

1. Soil Density Measurement

Advanced signal processing techniques are being applied to soil radar data to improve measurement resolution and remove interfering reflections and antenna beam width artifacts. Homomorphic processing techniques and adaptive filters are being investigated to remove psuedo stationary statistical noise. The signal processing techniques which show significant improvement in the data, and where they can be reasonably implemented will be included in the measuring system for realtime processing in the field.

2. Airborne Field Mill System

An airborne electric field measurement system has been developed at KSC for use in both propeller driven and jet aircraft. The system measures the electric field present in the clouds during thunderstorm activity. The magnitude of the electric field and its direction are displayed on-board. All data are recorded simultaneously on a flexible disk recorder for later data reduction and analysis. The system is controlled by a commercially available desktop computer.

3. Corrosion Control Manual for the Rapid Transit Industry

Corrosion control technology developed and tested at KSC will be transferred to the rapid transit industry in the form of a manual. After an extensive literature search on the subject the facilities of ten rapid transit systems throughout the country were inspected and a number of corrosion problems were identified, photographed, and categorized into basic corrosion control systems. The manual is expected to be completed in 1981 and presented to the rapid transit industry for their use.

4. Improved Image Processing of Medical Data

Image processing and analysis techniques were developed at KSC for pattern recognition in ultrasound mammograms. This technology was presented to technical and design personnel at the Drexel Institute and to medical personnel at the Thomas Jefferson University. The users are now adapting these techniques to more automated pattern recognition schemes more suitable to their own purposes. The technology transfer is complete.